

GMAT Arithmetic: Challenge

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1 Introduction

This document contains nothing but difficult GMAT Arithmetic questions—100 of them, to be exact. The term "arithmetic" doesn't sound particularly hard: it conjures up memories of multiplication tables and long division from elementary school. However, simple concepts are the ones the GMAT most likes to test, but in devilish ways. In fact, some of the trickiest questions on the test are based on concepts such as remainders and averages.

As in all of my GMAT preparation resources, you'll find these questions indexed by difficulty. That doesn't mean you should skip straight to the hardest questions, or even that you should start with the easier ones. On the GMAT itself, questions won't come labeled with their difficulty level, and despite the intent of the adaptive algorithm, they won't be precisely consistent in terms of difficulty either. Each question presents its own unique challenges, and the sooner you get accustomed to changing gears with every single question, the more time you'll have to prepare for that particular challenge of the exam.

For further, more specific practice, I have produced several other resources that may help you. Another one of my 100-question practice sets, "Statistics and Sets," focuses entirely on statistical measures such as average, mean, median, range, and standard deviation, along with set-related issues, such as Venn diagrams. I've also created a 100-question set called "Exponents and Roots," which covers exactly that material, including dozens of questions that force you to master every last exponent-related rule the GMAT will test you on.

Also, The GMAT Math Bible has several chapters (along with focused practice) on Arithmetic and related issues, including individual chapters on fractions, decimals, exponents, roots, ratios, percents, rate, mixture, interest, average, weighted average, statistics, overlapping sets, sequences, and more.

If you find yourself having problems with only the most difficult questions, you might try my "Extreme Challenge" set, which contains only 720 and higher level questions, many of which are Arithmetic-related.

As far as strategy is concerned, there are dozens of articles at GMAT HACKS to help you with your strategic approach to Arithmetic questions. Most importantly, you should make sure you understand every practice problem you do. It doesn't matter if you get it right the first time—what matters is whether you'll get it right the next time you see it, because the next time you see it could be on the GMAT.

With that in mind, carefully analyze the explanations. Redo questions that took you too long the first time around. Review questions over multiple sessions, rather than cramming for eight hours straight each Saturday. These basic study skills may not feel like the key to GMAT preparation, but they are the difference between those people who reach their score goals and those who never do.

Enough talking; there are 100 Arithmetic questions waiting inside. Get to work!

2 Difficulty Levels

In general, the level 5 questions in this guide are 560- to 620-level questions. The level 6 questions represent a broad range of difficulty from about 620 to 720, while the level 7 questions are higher still.

Moderately Difficult (5)

PS

3, 5, 14, 15, 21, 24, 28, 30, 31, 35, 43, 49, 51, 54, 58, 63, 66

DS

74, 76, 79, 81, 83, 86, 87, 89, 93, 99, 100

Difficult (6)

PS

2, 4, 6, 9, 10, 12, 13, 16, 17, 18, 20, 22, 23, 25, 26, 27, 29, 34, 36, 37, 39, 40,
41, 42, 44, 45, 46, 47, 48, 50, 52, 53, 55, 57, 59, 60, 61, 62, 64, 65, 69

DS

71, 73, 75, 77, 78, 80, 82, 90, 92, 94, 95, 96, 97, 98

Very Difficult (7)

PS

1, 7, 8, 11, 19, 32, 33, 38, 56, 67, 68, 70

DS

72, 84, 85, 88, 91

3 Problem Solving

Note: this guide contains both an answer key (so you can quickly check your answers) and full explanations.

1. If n is an integer and $\frac{3n}{7}$ is a perfect square, the smallest possible value of n is
 - (A) 3
 - (B) 7
 - (C) 21
 - (D) 42
 - (E) 147
2. The product of the five smallest two-digit prime numbers is closest to which of the following powers of 10?
 - (A) 10^9
 - (B) 10^8
 - (C) 10^7
 - (D) 10^6
 - (E) 10^5
3. If a number between 0 and $\frac{1}{2}$ is selected at random, which of the following will the number most likely be between?
 - (A) 0 and $\frac{1}{9}$
 - (B) $\frac{1}{9}$ and $\frac{1}{7}$
 - (C) $\frac{1}{7}$ and $\frac{1}{5}$
 - (D) $\frac{1}{5}$ and $\frac{1}{3}$
 - (E) $\frac{1}{3}$ and $\frac{1}{2}$
4. If set S consists of 5 consecutive integers and the average of set S is x , which of the following must be true?
 - I. x is an integer
 - II. x is the median of set S
 - III. The difference between x and the largest number in set S is equal to the difference between x and the smallest number in set S.
 - (A) II only
 - (B) III only
 - (C) I and III
 - (D) II and III
 - (E) I, II, and III

3. *PROBLEM SOLVING*

5. $(\sqrt{2} - 1)(\sqrt{2} + 1)(\sqrt{3} - 1)(\sqrt{3} + 1) =$
- (A) 1
 - (B) $\sqrt{3}$
 - (C) 2
 - (D) $\sqrt{6}$
 - (E) 6
6. The average (arithmetic mean) of the integers from 100 to 500, inclusive, is how much greater than the average of the integers from 10 to 50, inclusive?
- (A) 450
 - (B) 300
 - (C) 270
 - (D) 250
 - (E) 90
- a, b, c, d, e
7. An arithmetic sequence is a sequence in which each term after the first is equal to the sum of the preceding term and a constant. If the list of numbers shown above is an arithmetic sequence, which of the following must also be an arithmetic sequence?
- I. $a - 3, b - 3, c - 3, d - 3, e - 3$
 - II. a^3, b^3, c^3, d^3, e^3
 - III. $4a, 4b, 4c, 4d, 4e$
- (A) I only
 - (B) II only
 - (C) III only
 - (D) I and II
 - (E) I and III
8. If j and k are integers and $\frac{j^2}{k}$ is odd, which of the following must be true?
- (A) j and k are both even
 - (B) $j = k$
 - (C) If j is even, k is even
 - (D) j is divisible by k
 - (E) $j^2 > k$

3. *PROBLEM SOLVING*

9. R is a set containing 8 different numbers. S is a set containing 7 different numbers, all of which are members of R. Which of the following statements CANNOT be true?
- (A) The range of R is less than the range of S.
 - (B) The mean of R is greater than the mean of S.
 - (C) The range of R is equal to the range of S.
 - (D) The mean of R is less than the mean of S.
 - (E) The mean of R is equal to the mean of S.
10. If $\frac{1}{3} + \frac{1}{6} + \frac{1}{9} = \frac{22}{x}$, which of the following must be an integer?
- I. $\frac{x}{8}$
 - II. $\frac{x}{12}$
 - III. $\frac{x}{24}$
 - (A) I only
 - (B) II only
 - (C) I and III only
 - (D) II and III only
 - (E) I, II, and III
- I. j, k, m, n, p
 II. $j - 10, m, m, m, p + 15$
 III. $j + 2, k + 1, m, n - 1, p - 2$
11. If j, k, m, n , and p are consecutive positive integers such that $j < k < m < n < p$, the data sets I, II, and III above are ordered from greatest standard deviation to least standard deviation in which of the following?
- (A) I, III, II
 - (B) II, I, III
 - (C) II, III, I
 - (D) III, I, II
 - (E) III, II, I
12. For all numbers a and b , the operation $\#$ is defined by $a\#b = \frac{a-1}{b-1}$. If $3\#y = \frac{1}{2}$, then $y =$
- (A) $\frac{1}{4}$
 - (B) 4
 - (C) 5
 - (D) 7
 - (E) 8

3. *PROBLEM SOLVING*

13. If p is the average (arithmetic mean) of the first 12 positive multiples of 6 and if P is the median of the first 12 positive multiples of 6, what is the value of $P - p$?
- (A) 39
(B) 36
(C) 6
(D) 0
(E) -6
14. What is the 26th digit to the right of the decimal point in the decimal form of $\frac{1}{99}$?
- (A) 9
(B) 6
(C) 3
(D) 1
(E) 0
15. $\sqrt{997}$ is between
- (A) 31 and 32
(B) 32 and 33
(C) 33 and 34
(D) 34 and 35
(E) 35 and 36
16. A polling company found that, of 300 households surveyed, 120 spent at least \$100 per month on both gasoline and electricity, 60 spent at least \$100 per month on gasoline but not on electricity, and for every household that did not spend at least \$100 per month on gasoline or electricity, 4 spent at least \$100 per month on electricity but not on gasoline. How many of the 300 households did not spend at least \$100 per month on either gasoline or electricity?
- (A) 24
(B) 30
(C) 36
(D) 90
(E) 96
17. Positive integer p is 16 percent of 16 percent of positive integer q , and p percent of q equals 16. What is the value of q ?
- (A) 125
(B) 160
(C) 240
(D) 250
(E) 4,000

3. *PROBLEM SOLVING*

18. Which of the following is NOT equal to the cube of an integer?
- (A) $0^2 + -1^2$
 - (B) $3^2 - 1^2$
 - (C) $6^2 - 3^2$
 - (D) $7^2 + 5^2$
 - (E) $10^2 + 5^2$
19. If k is a positive integer, and if the units' digit of k^2 is 9 and the units' digit of $(k+1)^2$ is 6, what is the units' digit of $(k+2)^2$?
- (A) 1
 - (B) 3
 - (C) 5
 - (D) 7
 - (E) 9
20. If $(7^{\frac{2}{3}})^n = 7$, what is the value of n ?
- (A) $\frac{1}{3}$
 - (B) $\frac{2}{3}$
 - (C) $\frac{3}{4}$
 - (D) $\frac{3}{2}$
 - (E) 3
- 41, 47, 54, 43, 35, 70, 88, 76
21. Which of the following numbers is greater than three-fourths of the numbers but less than than one-fourth of the numbers in the list above?
- (A) 55
 - (B) 69
 - (C) 71
 - (D) 77
 - (E) 80
22. If x and y are positive integers and $x^4 + y^4 < 1,000$, then the greatest possible value of x is between
- (A) 0 and 2
 - (B) 2 and 4
 - (C) 4 and 6
 - (D) 6 and 8
 - (E) 8 and 10

3. *PROBLEM SOLVING*

23. If the average of k and $(x + 2)^2$ is $x^2 + 4$, what is the value of k ?
- (A) $x(x - 2)$
(B) $x(x - 4)$
(C) $(x + 2)(x - 2)$
(D) $(x + 2)^2$
(E) $(x - 2)^2$
24. Of the following, which is third greatest?
- (A) $\frac{1}{0.25}$
(B) $(0.25)^2$
(C) 0.025
(D) $\frac{0.25}{2.5}$
(E) 0.25
25. The value of $\sqrt[3]{-83}$ is
- (A) between -9 and -10
(B) between -8 and -9
(C) between -4 and -5
(D) between -3 and -4
(E) undefined
26. Which of the following is equal to x^{100} for all positive values of x ?
- (A) $(x^{50})^{50}$
(B) $(x^{20})^{80}$
(C) $\frac{x^{20}}{x^{120}}$
(D) $x^{50} + x^{50}$
(E) $(x^{10})^{10}$
27. For how many integers n is $-1^2 = n^{-1}$?
- (A) None
(B) One
(C) Two
(D) Three
(E) More than three

3. *PROBLEM SOLVING*

28. The contents of a certain box consist of 24 mangos and 30 kiwis. How many kiwis must be added to the box so that exactly 30% of the pieces of fruit in the box will be mangos?
- (A) 24
(B) 26
(C) 30
(D) 46
(E) 50
29. If $\frac{x}{y} = \frac{2}{3}$, then $\frac{x+y}{x-y} =$
- (A) 5
(B) $\frac{1}{5}$
(C) $-\frac{1}{6}$
(D) $-\frac{1}{5}$
(E) -5
30. If a number between $\frac{1}{2}$ and 1 is selected at random, which of the following will the number most likely be between?
- (A) $\frac{1}{2}$ and $\frac{3}{5}$
(B) $\frac{3}{5}$ and $\frac{5}{8}$
(C) $\frac{5}{8}$ and $\frac{3}{4}$
(D) $\frac{3}{4}$ and $\frac{5}{6}$
(E) $\frac{5}{6}$ and 1
- 14, j , 5, k , 21
31. If $k = 12$ and k is the arithmetic mean and median of the list above, what is the value of j ?
- (A) 8
(B) 9
(C) 10
(D) 11
(E) 12
32. If $y > 0$ and x is y percent of y , then, in terms of y , y is what percent of x ?
- (A) $\frac{1}{y}$
(B) $\frac{1}{100y}$
(C) $100y$
(D) $\frac{10,000}{y}$
(E) $\frac{1}{10,000y}$

3. *PROBLEM SOLVING*

33. The positive integer n is divisible by 7. If n^2 is greater than 1000, which of the following is the smallest possible value of $\frac{n}{7}$?
- (A) 3.5
 - (B) 4
 - (C) 4.5
 - (D) 5
 - (E) 6
34. Which of the following expresses the sum of the first 50 positive even integers?
- (A) $(2)(50)$
 - (B) $(25)(100)$
 - (C) $(25)(102)$
 - (D) $(50)(100)$
 - (E) $(50)(102)$
35. If $n = \sqrt{\frac{81}{256}}$, what is the value of \sqrt{n} ?
- (A) $\frac{9}{64}$
 - (B) $\frac{3}{16}$
 - (C) $\frac{9}{16}$
 - (D) $\frac{3}{4}$
 - (E) $\frac{9}{4}$
36. If a and b are integers and a^2b is odd, all of the following must be odd EXCEPT
- (A) a
 - (B) b
 - (C) ab
 - (D) $ab - a$
 - (E) $2a + b$
37. S is a set containing 6 different positive even numbers. T is a set containing 5 different numbers, all of which are members of S. Which of the following statements CANNOT be true?
- (A) The median of S is odd.
 - (B) The median of T is odd.
 - (C) The mean of S is odd.
 - (D) The mean of S is greater than the mean of T.
 - (E) The median of S is greater than the median of T.

3. *PROBLEM SOLVING*

38. If p is a positive integer and p^3 is divisible by 144, then the largest positive integer that must divide p is
- (A) 2
 - (B) 3
 - (C) 4
 - (D) 6
 - (E) 12
39. $\frac{(8^2)(4^2)(2^2)}{64^2} =$
- (A) $\frac{1}{8}$
 - (B) $\frac{1}{4}$
 - (C) $\frac{1}{2}$
 - (D) 1
 - (E) 2
40. If $p \rightarrow q = (p + q) - (p - q)$ for all integers p and q , then $(-2) \rightarrow 3 =$
- (A) -10
 - (B) -6
 - (C) 0
 - (D) 2
 - (E) 6
41. Exactly 14% of the reporters for a certain wire service cover local politics in Country X. If 30% of the reporters who cover politics for the wire service do not cover local politics in Country X, what percent of the reporters for the wire service do not cover politics?
- (A) 20%
 - (B) 42%
 - (C) 44%
 - (D) 80%
 - (E) 84%
42. A team of researchers measured each of ten subjects' reaction time to a certain stimulus and calculated the mean, median, and standard deviation of the measurements. If none of the reaction times were identical and an eleventh data point were added that was equal to the mean of the initial group of ten, which of these three statistics would change?
- (A) The median only
 - (B) The standard deviation only
 - (C) The mean and the median
 - (D) The mean and the standard deviation
 - (E) The median and the standard deviation

3. *PROBLEM SOLVING*

43. If the number of visitors to a certain website on the 1st of the month was 1.5 times the number of visitors on the 2nd of the month, and the number of visitors on the 3rd and 4th of the month was each $\frac{3}{4}$ the number of visitors on the 2nd of the month, then the number of visitors on the 1st of the month was how many times the average (arithmetic mean) of the number of visitors for the first four days of the month?
- (A) $\frac{3}{4}$
(B) $\frac{5}{6}$
(C) $1\frac{1}{2}$
(D) 2
(E) $2\frac{1}{2}$
44. If m is the average (arithmetic mean) of the first 20 positive multiples of 5, what is the value of $\frac{m}{5}$?
- (A) 10
(B) 10.25
(C) 10.5
(D) 11
(E) 50
45. A polling company found that, of 400 people polled, 180 did not have a positive impression of either Candidate A or Candidate B, 100 had a positive impression of Candidate A but did not have a positive impression of Candidate B, and for every person who had a positive impression of both candidates, 2 had a positive impression of Candidate B but did not have a positive impression of Candidate A. How many of the 400 people polled had a positive impression of both candidates?
- (A) 20
(B) 40
(C) 60
(D) 80
(E) 100

3. *PROBLEM SOLVING*

46. Among a population of 24,000 people, 80 percent own a personal computer, 88 percent own a car, and 72 percent own both a personal computer and a car. If 1 person is to be randomly selected from the 24,000 people, what is the probability that the person selected will be one who owns a car but does NOT own a personal computer?
- (A) $\frac{22}{25}$
(B) $\frac{1}{2}$
(C) $\frac{4}{25}$
(D) $\frac{3}{25}$
(E) $\frac{2}{25}$
47. If $(4^{\frac{1}{3}})^n = 8$, what is the value of n ?
- (A) $\frac{9}{2}$
(B) $3\sqrt{2}$
(C) 3
(D) $\frac{3}{2}$
(E) 2
48. The average (arithmetic mean) of the even integers from 100 to 200, inclusive, is how much greater than the average of the odd integers from 75 to 125, inclusive?
- (A) 10
(B) 25
(C) 45
(D) 50
(E) 75
49. Positive integer p is 50 percent of 50 percent of positive integer q , and p percent of q equals 400. What is the value of q ?
- (A) 100
(B) 200
(C) 400
(D) 800
(E) 2,000

3. *PROBLEM SOLVING*

50. The product of the first eight positive even integers is closest to which of the following powers of 10?
- (A) 10^9
 - (B) 10^8
 - (C) 10^7
 - (D) 10^6
 - (E) 10^5
51. If x and y are positive integers and $x^2 + y^2 = 100$, then the greatest possible value of x is between
- (A) 4 and 5
 - (B) 6 and 7
 - (C) 7 and 8
 - (D) 9 and 10
 - (E) 10 and 11
52. If $\sqrt{2-x} = \sqrt{2x} - 2$, then $9x^2 =$
- (A) 1
 - (B) 4
 - (C) $1 - 6x$
 - (D) $14x - 1$
 - (E) $20x - 4$
53. If $4^{x+1} = 8^{x-1}$, then $x =$
- (A) -1
 - (B) 0
 - (C) 1
 - (D) 2
 - (E) 5
54. The value of $\sqrt[3]{-43}$ is
- (A) between -7 and -8
 - (B) between -6 and -7
 - (C) between -5 and -6
 - (D) between -4 and -5
 - (E) between -3 and -4
55. Which of these fractions has the greatest value?
- (A) $\frac{3}{2^2 5^2}$
 - (B) $\frac{26}{2^2 5^3}$
 - (C) $\frac{9}{2^3 5^2}$
 - (D) $\frac{49}{2^3 5^3}$
 - (E) $\frac{92}{2^4 5^3}$

3. *PROBLEM SOLVING*

56. $(\sqrt{8 + \sqrt{63}} - \sqrt{8 - \sqrt{63}})^2$
(A) 14
(B) $14\sqrt{2}$
(C) 16
(D) $16\sqrt{2}$
(E) 18
57. Of the C condominiums in a certain building complex, $\frac{2}{3}$ have at least two bedrooms. If, of those, $\frac{1}{4}$ have at least two bathrooms, which of the following expressions represents the number of condominiums in the complex with at least two bedrooms that do not have at least two bathrooms?
(A) $\frac{C}{2}$
(B) $\frac{C}{3}$
(C) $\frac{C}{4}$
(D) $\frac{C}{6}$
(E) $\frac{C}{12}$
58. If $\frac{x}{y} = \frac{3}{5}$, then $\frac{x}{y} + \frac{y}{x} =$
(A) $\frac{15}{34}$
(B) $\frac{5}{12}$
(C) $\frac{34}{15}$
(D) $\frac{12}{5}$
(E) $\frac{9}{2}$
59. If the average (arithmetic mean) of x and y is 75 and the average (arithmetic mean) of y and z is 90, what is the value of $z - x$?
(A) 7.5
(B) 15.0
(C) 30.0
(D) 52.5
(E) It cannot be determined from the information given.
60. If the two-digit integers A and B are positive and have the same digits, but in reverse order, which of the following CANNOT be the difference between A and B?
(A) 9
(B) 21
(C) 27
(D) 45
(E) 63

3. *PROBLEM SOLVING*

61. What is the units digit of $(19)^2(23)^3(31)^4$?
- (A) 1
 - (B) 3
 - (C) 5
 - (D) 7
 - (E) 9
62. The ratio, by volume, of flavoring to sugar to water in a certain soft drink is 2 : 10 : 50. The soft drink will be altered so that the ratio of flavoring to sugar is halved while the ratio of sugar to water is doubled. If the altered soft drink will contain 4 ounces of sugar, how many ounces of water will it contain?
- (A) 4
 - (B) 5
 - (C) 10
 - (D) 16
 - (E) 20
63. If $x > 0$, $\frac{x}{50} + \frac{x}{10}$ is what percent of x ?
- (A) 12%
 - (B) 24%
 - (C) 30%
 - (D) 40%
 - (E) 60%
64. If the average (arithmetic mean) of the four numbers M , $2M - 1$, $3M + 5$, and $5M - 3$ is 25, what is the value of M ?
- (A) $2\frac{2}{11}$
 - (B) 4
 - (C) 8
 - (D) 9
 - (E) $9\frac{1}{11}$
65. Of the 200 employees in a certain company, 25 percent will be relocated to City X and the remaining 75 percent will be relocated to City Y. However, 40 percent of the employees prefer City Y and 60 percent prefer City X. What is the highest possible number of employees who will be relocated to the city they prefer?
- (A) 65
 - (B) 100
 - (C) 115
 - (D) 130
 - (E) 135

3. PROBLEM SOLVING

66. $5 + \frac{4}{3 + \frac{2}{1 + \frac{1}{2}}} =$

- (A) $\frac{73}{12}$
- (B) $\frac{77}{13}$
- (C) $\frac{13}{3}$
- (D) $\frac{4}{3}$
- (E) $\frac{12}{13}$

x	r	s	t
a	30	6	18
2	10	x	6
b	20	4	y

67. In the multiplication table above, each number in the table is the product of the terms at the top of its column and the left of its row. What is the value of xy ?

- (A) 15
- (B) 16
- (C) 21
- (D) 24
- (E) 27

68. If $y^2 = 2$, what is the value of $\frac{2(x-y)(x+y)}{2(x-1)(x+1)}$?

- (A) -2
- (B) $-\frac{1}{2}$
- (C) $\frac{1}{2}$
- (D) 2
- (E) 4

3. *PROBLEM SOLVING*

69. In a certain lottery drawing, two balls are selected at random from a container with 100 balls, numbered from 1 to 100, inclusive. If the winner of the lottery is awarded a cash prize in the amount of \$1,000 times the product of the numbers on the two selected balls, which of the following is a possible amount of the cash prize given to the winner?
- (A) $\$9.85 \times 10^6$
 - (B) $\$9.90 \times 10^6$
 - (C) $\$1.00 \times 10^7$
 - (D) $\$1.05 \times 10^7$
 - (E) $\$9.90 \times 10^7$
70. John's car dealership contains m cars, 20% of which are minivans and 80% are sedans. Kevin's car dealership contains n cars, 40% of which are minivans and 60% are trucks. Larry's car dealership contains p cars, 50% of which are minivans and 50% of which are convertibles. If 25% of the $m + n + p$ cars contained at the three dealerships are minivans, what is m in terms of n and p ?
- (A) $n + 3p$
 - (B) $3n + 5p$
 - (C) $4n + 5p$
 - (D) $\frac{n+5p}{2}$
 - (E) $\frac{4n+5p}{3}$

4 Data Sufficiency

For all Data Sufficiency questions, the answer choices are as follows:

- (A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.
 - (B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.
 - (C) BOTH statements TOGETHER are sufficient, but NEITHER statement ALONE is sufficient.
 - (D) EACH statement ALONE is sufficient.
 - (E) Statements (1) and (2) TOGETHER are NOT sufficient.
71. If $y = 0.abcd$, where a , b , c , and d each represent a nonzero digit of y , what is the value of y ?
- (1) $a = d^2$ and $b = c^2$
 - (2) $a > b$
72. If a and b are positive integers, what is the remainder when 4^{2a+1+b} is divided by 10?
- (1) $a = 1$
 - (2) $b = 2$
73. 35 percent of the books in Richard's collection are novels and 60 percent of the books are paperbacks. If 20 percent of the paperbacks in Richard's collection are novels published before 1940, how many of the paperbacks in Richard's collection are novels published before 1940.
- (1) Non-fiction books make up exactly half of Richard's collection.
 - (2) 100 of the books in Richard's collection are non-fiction.
74. The number N is $2,3H4$ the ten's digit being represented by H . What is the value of H ?
- (1) N is divisible by 9.
 - (2) N is divisible by 4.
75. If x is less than 75 percent of y , is x less than 75 ?
- (1) $y > 20$
 - (2) $x + 25 = y$

4. DATA SUFFICIENCY

76. A Town T has 40,000 residents, 25 percent of whom are age 60 or older. What percent of the residents are female?
- (1) The number of female residents of Town T age 60 or older is 30 percent of the number of female residents who are not 60 or older.
 - (2) 37 percent of the residents of Town T are males who are not 60 or older.
77. For a certain set of n numbers, where $n > 2$, is the average (arithmetic mean) equal to the median?
- (1) The n numbers are positive, consecutive even integers.
 - (2) The average of the n numbers is equal to the average of the largest and smallest numbers in the set.
78. If k is an even integer, what is the remainder when k is divided by 10 ?
- (1) The remainder when k is divided by 5 is equal to the remainder when k is divided by 10.
 - (2) The remainder is greater than 3.
79. In the fraction $\frac{r}{s}$, where r and s are positive integers, what is the value of s ?
- (1) The least common denominator of $\frac{r}{s}$ and $\frac{1}{4}$ is 20.
 - (2) $r = 1$
80. The symbol ∇ represents one of the following operations: addition, subtraction, multiplication, or division. What is the value of $5\nabla 2$?
- (1) $2\nabla 5 = 10$
 - (2) $5\nabla 5 = 25$
81. In Garfield School, 250 students participate in debate or student government or both. If 40 of these students participate in both debate and student government, how many of these students do not participate in debate?
- (1) 80 of the students do not participate in student government.
 - (2) In Garfield School, 150 students do not participate in either debate or student government.

4. DATA SUFFICIENCY

82. If the units digit of integer n is greater than 2, what is the units digit of n ?
- (1) The units digit of n is not the same as the units digit of n^2 .
 - (2) The units digit of n is the same as the units digit of n^3 .
83. Of the students in a certain class, 15 percent have a birthday on an even-numbered day in the first three months of the year. What percent of the students have a birthday on an odd-numbered day?
- (1) 40 percent of the students have a birthday on an even-numbered day in the last nine months of the year.
 - (2) Of the students who have a birthday on an odd-numbered day, 30 percent have a birthday in the first three months of the year.
84. Any decimal that has only a finite number of nonzero digits is a terminating decimal. For example, 25, 0.09, and 8.072 are three terminating decimals. If p and q are positive integers and the ratio $\frac{p}{q}$ is expressed as a decimal, is $\frac{p}{q}$ a terminating decimal?
- (1) q is a prime number less than 10.
 - (2) q is not equal to 3 or 7.
85. If Z is the infinite sequence $Z_1 = 3, Z_2 = 9, Z_3 = 33, \dots, Z_k = 2^{2^{k-1}} + 1, \dots$, is every term in Z divisible by the prime number p ?
- (1) At least one term in sequence Z is divisible by p .
 - (2) $p = 3$
86. If the average (arithmetic mean) of six numbers j, k, m, n, p , and q is 56, how many of the numbers are equal to 56?
- (1) The sum of j and p is 128.
 - (2) The sum of m, n , and q is 152.

4. DATA SUFFICIENCY

87. The monthly revenue of Company A increased by 20 percent over the same time period that the monthly revenue of Company B decreased by 25 percent. The reduced monthly revenue of Company B was what percent of the original monthly revenue of Company A?
- (1) The original monthly revenue of Company A was equal to the original monthly revenue of Company B.
 - (2) The increased monthly revenue of Company A was 60 percent greater than the reduced monthly revenue of Company B.
88. If m and n are positive integers, what is the units' digit of 7^{m+3+4n} ?
- (1) $m = 7$
 - (2) $n = 2$
89. If x is a positive integer, is $x > 25$?
- (1) x is less than the average (arithmetic mean) of the first ten positive multiples of 5.
 - (2) x is greater than the average (arithmetic mean) of the first eight positive multiples of 5.
90. Of the 250 members of a certain legislative body, 20% have a doctorate and are more than 50 years old. How many of the 250 members have a doctorate and are 50 years old or less?
- (1) 15% of the members do not have a doctorate and are 50 years old or less.
 - (2) 70% of the members are more than 50 years old.
91. If p is a positive odd integer, what is the remainder when p is divided by 3 ?
- (1) When p is divided by 12, the remainder is 7.
 - (2) $p = n(n + 1) + 1$, where n is an integer.
92. What is the hundredths digit of the decimal m ?
- (1) The tenths digit of $100m$ is 5.
 - (2) The tens digit of $1,000m$ is 5.
93. Is c equal to the median of the three positive integers a , b , and c ?
- (1) $a = c$
 - (2) $b - a < c$

4. DATA SUFFICIENCY

94. At least 100 students at a certain high school study Mandarin. If 10 percent of the students at the school who study Spanish also study Mandarin, do more students at the school study Spanish than Mandarin?
- (1) 6 percent of the students at the school who study Mandarin also study Spanish.
 - (2) 60 students at the school study neither Spanish nor Mandarin.
95. In a certain marching band formation, each row of band members has the same number of members, and the number of rows is 1 less than the number of members in a row. How many band members are there in each row?
- (1) There is a total of 90 band members.
 - (2) If each of the members of the last row were assigned to a different row, the row with the least number of members would have 10 members.
96. During a heat wave, the water levels of six bodies of water decreased. If the standard deviation of the water levels of the bodies of water before the heat wave was 2.1 inches, what was the standard deviation of the water levels of the bodies of water after the heat wave?
- (1) During the heat wave, the water levels of the two of the bodies of water that decreased the most each decreased by 25 percent.
 - (2) During the heat wave, the water levels of the four of the bodies of water that decreased the least each decreased by 10 percent.
97. The symbol \Rightarrow represents one of the following operations: addition, subtraction, multiplication, or division. What is the value of $2 \Rightarrow 3$?
- (1) $1 \Rightarrow 2 < 0$
 - (2) $-2 \Rightarrow -1 < 0$
98. When an international relief agency extended loans to 28 countries, the unemployment rate dropped in some of the countries, and the per-capita GDP rose in some of the countries. In how many of the countries did the unemployment rate drop?
- (1) In 10 of the countries, the unemployment rate did not drop, and the per-capita GDP did not rise.
 - (2) In 12 of the countries, the per-capita GDP rose but the unemployment rate did not drop.

4. *DATA SUFFICIENCY*

99. If the units digit of integer n is greater than 2, what is the units digit of n ?
- (1) The units digit of n^2 is 9
 - (2) The units digit of n^3 is 7
100. For a certain set of 3 numbers, is the average (arithmetic mean) equal to the median?
- (1) The range of the set is double the difference between the smallest number in the set and the middle number.
 - (2) The set consists of the three numbers 10, 16, and 22.

5 Answer Key

For full explanations, see the next section.

1. C
2. D
3. E
4. E
5. C
6. C
7. E
8. C
9. A
10. B
11. B
12. C
13. D
14. D
15. A
16. A
17. D
18. D
19. C
20. D
21. C
22. C
23. E
24. D
25. C
26. E
27. B
28. B
29. E
30. E
31. A
32. D
33. D
34. C
35. D
36. D
37. B
38. E
39. D
40. E
41. D

5. ANSWER KEY

- 42. B
- 43. C
- 44. C
- 45. B
- 46. C
- 47. A
- 48. D
- 49. C
- 50. C
- 51. D
- 52. E
- 53. E
- 54. E
- 55. B
- 56. A
- 57. A
- 58. C
- 59. C
- 60. B
- 61. D
- 62. C
- 63. A
- 64. D
- 65. D
- 66. B
- 67. D
- 68. C
- 69. B
- 70. B
- 71. E
- 72. B
- 73. C
- 74. C
- 75. B
- 76. C
- 77. A
- 78. C
- 79. E
- 80. D
- 81. A
- 82. E
- 83. A
- 84. C
- 85. B
- 86. E
- 87. D

5. *ANSWER KEY*

- 88. A
- 89. E
- 90. C
- 91. A
- 92. B
- 93. A
- 94. A
- 95. A
- 96. E
- 97. A
- 98. C
- 99. B
- 100. D

6 Explanations

For a quick-reference answer key, see the previous section.

1. C

Explanation: In order for $\frac{3n}{7}$ to be a perfect square, n must not only divide 7, but after dividing by 7, it must combine with 3 to be a perfect square. If you use 7 as the value for n , it accomplishes the purpose of dividing 7, but that means that $\frac{3n}{7} = 3$, which is not a perfect square. You can create a perfect square by multiplying the result by 3, though, so try using a value of n that is multiplied by 3.

That means $n = 21$:

$\frac{3n}{7} = \frac{3(21)}{7} = 9$. That's a perfect square, and there's no way we could've found a smaller one, so choice (C) is correct.

2. D

Explanation: We're looking for the product of 11, 13, 17, 19, and 23. There's no way the GMAT expects us to do the arithmetic, so we should look for a faster way. We can approximate 11 times 19 and 13 times 17 as each roughly equivalent (or a bit less) to $15^2 = 225$. Since we're approximately, call those 200 each. That leaves us with:

$$23 \times 200 \times 200 \approx 20 \times 200 \times 200$$

Separate out the 2's:

$$2(10)(2)(100)(2)(100) = 2^3(10^1)(10^2)(10^2)$$

8 is, very approximately, 10, especially since we've been rounding down thus far:

$$10^1(10^1)(10^2)(10^2) = 10^6, \text{ choice (D).}$$

3. E

Explanation: This is where decimal equivalencies come in handy. The endpoints of these choices are approximately as follows:

$$\frac{1}{9} = 0.11$$

$$\frac{1}{7} = 0.14$$

$$\frac{1}{5} = 0.2$$

$$\frac{1}{3} = 0.33$$

$$\frac{1}{2} = 0.5$$

Thus, the ranges are as follows:

$$(A): \quad 0.11$$

$$(B): \quad 0.03$$

$$(C): \quad 0.06$$

$$(D): \quad 0.13$$

$$(E): \quad 0.17$$

The number is most likely to fall in the largest range, so the correct answer is (E).

6. EXPLANATIONS

4. E

Explanation: In a set with an odd number of consecutive integers (consider, for example, $\{1, 2, 3, 4, 5\}$), the mean is the middle number. So, I is correct: x , the mean, is an integer. That eliminates (A), (B) and (D).

II is also true: in a set of evenly-spaced (consecutive) terms, the mean and the median are equal. That eliminates (C). Let's look at III for the sake of completeness:

III is true, as well: this is another fact of consecutive sets. Using the example above, the difference between 3 and 5 is equal to the difference between 1 and 3. Thus, (E) is the correct choice.

5. C

Explanation: Despite all the radicals, this is essentially an algebra question: do you recognize the two sets of differences of squares?

$$(\sqrt{2} - 1)(\sqrt{2} + 1) = (\sqrt{2})^2 - 1^2 = 2 - 1 = 1$$

$$(\sqrt{3} - 1)(\sqrt{3} + 1) = (\sqrt{3})^2 - 1^2 = 3 - 1 = 2$$

The product is 2, choice (C).

6. C

Explanation: Given a lengthy set of integers, you aren't really expected to do the calculation. Instead, recognize that in a set of consecutive integers, the mean is the median of the set. The median is the halfway point in a set of consecutive integers. So, the median/mean of 100 to 500 is $\frac{500+100}{2} = 300$, and the median/mean of 10 to 50 is $\frac{10+50}{2} = 30$. The difference is 270, choice (C).

7. E

Explanation: When thinking about altering a sequence, it's useful to have a reference point. Let's say the original sequence is 4, 5, 6, 7, 8, which is an arithmetic sequence, as each term is equal to the preceding term and a constant.

Thus, I is equivalent to 1, 2, 3, 4, 5, which is also an arithmetic sequence—each term is equal to the preceding term plus 1.

II is equivalent to 16, 25, 36, 49, 64, which is not an arithmetic sequence. The space between each successive pair of terms is not equal.

III is 16, 20, 24, 28, 32, which is an arithmetic sequence. Each term is equal to the preceding term plus 4.

Thus, I and III are also arithmetic sequences, and choice (E) is correct.

8. C

Explanation: Go through each of the choices, trying to disprove each one:

(A) If j and k are both odd, the result can still be odd: for instance, if each is equal to 3, $\frac{3^2}{3} = 3$.

(B) They can be equal, but needn't be: if $j = 9$ and $k = 3$: $\frac{9^2}{3} = 27$.

(C) This is it. If j is even and k is not even, the result is even: $\frac{6^2}{3} = 12$. (It's also possible that the result is not an integer, as when $j = 6$ and $k = 5$.)

6. EXPLANATIONS

- (D) j^2 must be divisible by k , but j needn't be: if $j = 3$ and $k = 9$: $\frac{3^2}{9} = 1$.
 (E) As in the example for (D), j^2 and k can be equal.
 (C) is the correct choice.

9. A

Explanation: Here you have to go through each choice, eliminating those that can be true:

- (A) R has 8 terms, and S has 7 terms, all of which are in R, so there's no way the range of R can be less than the range of S. S cannot have endpoints that are further apart than the endpoints of R, because those endpoints must be in R! This is the correct answer.
 (B) If the one term that is in R and not in S is one of the larger terms, the mean of R will be greater than the mean of S.
 (C) If the one missing term in S is in the middle somewhere, the ranges will be equal.
 (D) If the one missing term in S is one of the smaller terms, the mean of S will be greater than the mean of R.
 (E) If the one missing term in S is equal to the mean of R, removing it doesn't affect the mean.
 Choice (A) is correct.

10. B

Explanation: First, simplify the question:

$$\frac{1}{3} + \frac{1}{6} + \frac{1}{9} = \frac{6}{18} + \frac{3}{18} + \frac{2}{18} = \frac{11}{18} = \frac{22}{36}.$$

Thus, $x = 36$.

In I, $\frac{36}{8} = 4.5$, which is not an integer. Eliminate (A), (C), and (E).

In II, $\frac{36}{12} = 3$, an integer.

In III, $\frac{36}{24} = 1.5$, not an integer. (B) is the correct choice.

11. B

Explanation: It's approximate, but a handy way to compare standard deviations is to find the average difference of each term from the mean. For instance, in I, the mean is m , and since the terms are consecutive integers, the differences from the mean are 2, 1, 0, 1, 2, for an average of $\frac{6}{5}$.

In II, the average difference is much greater. While the middle three terms are the same, the other two differences are 12 and 17 (j is already 2 less than m , and p is 2 greater), so the average difference is $\frac{29}{2} = 14.5$.

In III, the average difference is much smaller. Those five terms are actually equal. j is two less than m , so $j + 2$ is equal to m . k is one less than m , so $k + 1$ is equal to m . The same applies to the final two terms. All the terms are the same, so the standard deviation is zero.

Comparing those average differences, the sets are ranked, from greatest to least, II, I, III, choice (B).

12. C

6. EXPLANATIONS

Explanation: Plug in 3 and y to the given formula for the # sign:

$$\frac{a-1}{b-1} = \frac{3-1}{y-1} = \frac{2}{y-1}$$

That's equal to $\frac{1}{2}$, so solve for y :

$$\frac{2}{y-1} = \frac{1}{2}$$

$$4 = y - 1$$

$$y = 5, \text{ choice (C).}$$

13. D

Explanation: When a series of numbers is equally spaced, such as consecutive integers or, in this case, consecutive multiples of something, the mean and median are the same. There's no need to spend time calculating: since the first 12 positive multiples of 6 have the same mean and median, $P - p = 0$, choice (D).

14. D

Explanation: Here you'll have to do a bit of long division, but not 26 digits worth. If the GMAT asks a question like this, it's because there is a pattern in the decimal equivalent of $\frac{1}{99}$, and they want to see how quickly you can recognize it. Once you find the first three digits after the decimal point are 0.010, you should recognize that you've probably got the pattern. The odd numbered digits are 0, the even numbered digits are 1. So, the 26th digit is one of the even numbered digits, 1, choice (D).

15. A

Explanation: The most efficient way to do this is to use the answer choices. $32^2 = 1024$, so $\sqrt{1024} = 32$. $\sqrt{997}$ must be smaller than $\sqrt{1024}$, so $\sqrt{997}$ must be smaller than 32, which means it must be choice (A).

It wouldn't have been wrong to start with (E) instead of (A): just don't bother solving for 31^2 or 36^2 —those don't help you differentiate between answer choices. You know that $\sqrt{997}$ is larger than 31 and smaller than 36.

16. A

Explanation: The question divides the surveyed households into four categories, the sum of which will equal 300:

$$300 = \text{electricityOnly} + \text{gasolineOnly} + \text{both} + \text{neither}$$

Call the number who did not spend \$100 on either x , which means that $4x$ spent \$100 on electricity but not on gasoline. Plug in all those values:

$$300 = 4x + 60 + 120 + x$$

$$300 = 180 + 5x$$

$$120 = 5x$$

$$x = 24$$

x represents "neither", which is what we're looking for, so (A) is correct.

17. D

Explanation: It's tricky translation, but translation is all this question requires:

6. EXPLANATIONS

$$p = \frac{16}{100} \left(\frac{16}{100} q \right)$$

$$\frac{p}{100} q = 16$$

Solve for the second equation for p in terms of q , then plug into the first one:

$$p = 16 \left(\frac{100}{q} \right) = \frac{1600}{q}$$

$$\frac{1600}{q} = \frac{16}{100} \left(\frac{16}{100} q \right)$$

Divide 16 out of both sides:

$$\frac{100}{q} = \frac{1}{100} \left(\frac{16}{100} \right) q$$

$$100 = \frac{1}{100} \left(\frac{4}{25} \right) q^2$$

$$100 = \frac{1}{25^2} q^2$$

Take the square root of everything:

$$10 = \frac{1}{25} q$$

$$q = 10(25) = 250, \text{ choice (D).}$$

18. D

Explanation: Go through each choice, finding a value you can work with:

(A) $0 + 1 = 1$

(B) $9 - 1 = 8$

(C) $36 - 9 = 27$

(D) $49 + 25 = 74$

(E) $100 + 25 = 125$

Only (D) isn't a cube. 1 is the cube of 1, 8 is the cube of 2, 27 is the cube of 3, and 125 is the cube of 5.

19. C

Explanation: If the units' digit of k^2 is 9, that means the units digit of k must be 3 ($3^2 = 9$) or 7 ($7^2 = 49$).

If the units' digit of $(k+1)^2$ is 6, the units' digit of $k+1$ must be 4 ($4^2 = 16$) or 6 ($6^2 = 36$). The only pair of values for k and $k+1$ that agree are $k = 3$ and $k+1 = 4$, so $k+2 = 5$, which means that $(k+2)^2 = 5^2 = 25$, the units' digit of which is 5, choice (C).

20. D

Explanation: Rewrite the equation so that each side is 7 raised to a power:

$$7^{\frac{2}{3}n} = 7^1$$

Set the exponents equal to each other:

$$\frac{2}{3}n = 1$$

$$n = \frac{3}{2}, \text{ choice (D).}$$

21. C

Explanation: First, put the numbers in ascending order:

35, 41, 43, 47, 54, 70, 76, 88

There are 8 numbers, so something greater than three-fourths of the numbers and less than one-fourth must be between 70 and 76. The only possible choice that fits that description is (C), 71.

6. EXPLANATIONS

22. C

Explanation: To maximize x , minimize y . If y must be a positive integer, the smallest it can be is 1, so:

$$x^4 + 1^4 < 1,000$$

$$x^4 < 999$$

$$\sqrt{x^4} < \sqrt{999}$$

$$x^2 < 32 \text{ (it's an approximation, but close enough)}$$

$$\sqrt{x^2} < \sqrt{32}$$

$$x < 4\sqrt{2} \approx 5.6$$

The greatest possible value, then, is between 4 and 6, choice (C).

23. E

Explanation: Jump right in to the algebra:

$$\frac{k+(x+2)^2}{2} = x^2 + 4$$

$$k + (x+2)^2 = 2x^2 + 8$$

$$k + x^2 + 4x + 4 = 2x^2 + 8$$

$$k = x^2 - 4x + 4$$

$$k = (x-2)^2, \text{ choice (E).}$$

24. D

Explanation: To simplify these, it's probably easiest to translate each to a fractional equivalent:

$$(A) \quad \frac{1}{\frac{1}{4}} = 4$$

$$(B) \quad \left(\frac{1}{4}\right)^2 = \frac{1}{16}$$

$$(C) \quad \left(\frac{1}{10}\right)(0.25) = \left(\frac{1}{10}\right)\left(\frac{1}{4}\right) = \frac{1}{40}$$

$$(D) \quad \frac{1}{10}$$

$$(E) \quad \frac{1}{4}$$

In ascending order, those are:

$$\frac{1}{40}, \frac{1}{16}, \frac{1}{10}, \frac{1}{4}, 4$$

So the third greatest is $\frac{1}{10}$, choice (D).

25. C

Explanation: You should know that $4^3 = 64$, so $(-4)^3 = -64$. Similarly, $(-5)^3 = -125$, so the endpoints of (C) are equivalent to $\sqrt[3]{-64}$ and $\sqrt[3]{125}$. $\sqrt[3]{-83}$ is between those, so it must be between -4 and -5, choice (C).

26. E

Explanation: Go through the choices, simplifying where possible:

$$(A) \quad x^{50(50)} = x^{2500}$$

$$(B) \quad x^{20(80)} = x^{1600}$$

$$(C) \quad x^{20-120} = x^{-100}$$

$$(D) \quad 2(x^{50})$$

$$(E) \quad x^{10(10)} = x^{100}, \text{ so that's correct.}$$

27. B

6. EXPLANATIONS

Explanation: $-1^2 = 1$, so we want to know how many values of n result in $n^{-1} = 1$.

Put another way: how many values of n result in $\frac{1}{n} = 1$. There's only one: $n = 1$, so choice (B) is correct.

28. B

Explanation: The number of mangos will stay the same, at 24, so we want to know how many total pieces of fruit would be required for the number of mangos to represent 30% of the total in the box. We can solve for that:

$$24 = 0.3t$$

$$24 = \frac{3}{10}t$$

$$t = 24\left(\frac{10}{3}\right) = 80$$

If there are 80 total pieces of fruit in the box and 24 of them are mangos, that leaves 56 kiwis. There are currently 30 kiwis, so we need to add 26 more, choice (B).

29. E

Explanation: The question makes it appear that the answer will always be the same, so we can assign one set of values for the variables according to the ratio given. To keep it simple, let's say that $x = 2$ and $y = 3$. Then:

$$\frac{x+y}{x-y} = \frac{2+3}{2-3} = \frac{5}{-1} = -5, \text{ choice (E).}$$

30. E

Explanation: Find the decimal equivalents of each of the endpoints:

$$\frac{1}{2} = 0.5$$

$$\frac{1}{3} = 0.6$$

$$\frac{1}{5} = 0.625$$

$$\frac{1}{4} = 0.75$$

$$\frac{4}{5} = 0.87$$

Thus, the ranges represented by each of the choices are:

(A) 0.1

(B) 0.025

(C) 0.125

(D) 0.12

(E) 0.13

The number is most likely to fall into the largest range, so the correct answer is (E).

31. A

Explanation: If $k = 12$, the set looks like this, in order:

5, 12, 14, 21 with j somewhere in there.

Since 12 is the mean, we can solve for j :

$$12 = \frac{5+12+14+21+j}{5}$$

$$60 = 52 + j$$

$$j = 8, \text{ choice (A).}$$

6. EXPLANATIONS

32. D

Explanation: Translate the statement to algebra:

$$x = \frac{y}{100}y$$

y is what percent of x looks like this, where that percent is p :

$$y = \frac{p}{100}x$$

We're looking for p , so solve that for p :

$$p = \frac{100y}{x}$$

To eliminate the x 's (there aren't any x 's in the answer choices), try to solve the first equation for $\frac{y}{x}$:

$$x = \frac{y}{100}y$$

$$\frac{x}{y} = \frac{y}{100}$$

$$\frac{y}{x} = \frac{100}{y}$$

Plug that in to the p equation:

$$p = \frac{100y}{x} = 100\left(\frac{100}{y}\right) = \frac{10,000}{y}, \text{ choice (D).}$$

33. D

Explanation: If n^2 is greater than 1000, then n is greater than $\sqrt{1000}$, which is approximately 32. Thus, $\frac{n}{7}$ is greater than $\frac{32}{7} \approx 4.6$. That's all we need to figure out: the smallest possible value of $\frac{n}{7}$ is the next integer, 5. It must be an integer because n is divisible by 7.

34. C

Explanation: The first 50 even integers are the consecutive evens between 2 and 100, inclusive. The mean of those 50 numbers is equal to the median, which is equal to the mean of the two endpoints. So, the mean is $\frac{100+2}{2} = 51$.

That's useful because the sum of the terms is equal to the number of terms multiplied by the average. We know there are 50 terms and the average is 51, so the sum is:

$$(50)(51)$$

That's not one of the choices, but if alter it a bit, it becomes one:

$$(2)(25)(51) = (25)(102), \text{ choice (C)}$$

35. D

$$\text{Explanation: } n = \sqrt{\frac{81}{256}} = \frac{\sqrt{81}}{\sqrt{256}} = \frac{9}{16}$$

$$\sqrt{n} = \sqrt{\frac{9}{16}} = \frac{\sqrt{9}}{\sqrt{16}} = \frac{3}{4}, \text{ choice (D).}$$

36. D

Explanation: If a^2b is odd, then both a^2 and b must be odd. If a^2 is odd, a must be odd as well. Go through each choice:

$$(A) \quad a = \text{odd}$$

$$(B) \quad b = \text{odd}$$

$$(C) \quad ab = (\text{odd})(\text{odd}) = \text{odd}$$

$$(D) \quad ab - a = (\text{odd})(\text{odd}) - \text{odd} = \text{odd} - \text{odd} = \text{even}$$

$$(E) \quad 2a + b = 2(\text{odd}) + \text{odd} = \text{even} + \text{odd} = \text{odd}$$

(D) is the only even option, so that's our answer.

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37. B

Explanation: Go through each of the choices:

(A) The median of S is the average of the two middle numbers. If those two numbers are 4 and 6, for example, the median will be odd.

(B) This is impossible. T has an odd number of terms, all of which are even, so the median must be one of the terms, which must be even.

(C) In (A), we saw that the median could be odd; if the terms are consecutive evens, the mean and the median are the same.

(D) If the "missing term" in T is larger than the mean, S will have a higher mean than T.

(E) Similar to (D) – if the missing term in T is larger than the median of S, S will have a higher median.

(B) is the correct choice.

38. E

Explanation: $144 = 12^2$, but it isn't the cube of anything. Thus, if p^3 is divisible by 144, it must be bigger than 144 – it must be 12^3 or a multiple thereof. So, if p^3 must be 12^3 or a multiple of it, then p must be 12 of a multiple of 12. Choice (E) is correct.

39. D

Explanation: Start by cancelling out the largest numbers you can:

$$\frac{(8^2)(4^2)(2^2)}{64^2} = \frac{(8^2)(4^2)(2^2)}{8^2 8^2} = \frac{(4^2)(2^2)}{8^2}$$

Now, it's probably fastest reduce everything to 2's:

$$\frac{(4^2)(2^2)}{8^2} = \frac{(2^2)^2 2^2}{(2^3)^2} = \frac{2^4 2^2}{2^6} = \frac{2^6}{2^6} = 1, \text{ choice (D).}$$

40. E

Explanation: Plug in -2 and 3 for p and q in the given formula:

$$(p + q) - (p - q)$$

$$((-2) + 3) - ((-2) - 3)$$

$$(1) - (-5) = 6, \text{ choice (E).}$$

41. D

Explanation: 30% of the reporters who cover politics do not cover local politics in X, so 70% of the reporters who cover politics DO cover local politics in X.

Thus, 14% of the total reporters is the same as 70% of the reporters who cover politics:

$$0.14 = 0.7p$$

$$p = \frac{0.14}{0.7} = \frac{14}{70} = 0.2$$

20% of the total reporters cover politics, so 80% do not cover politics, choice (D).

42. B

Explanation: When you add a term to a set that is equal to the previous mean of the set, it doesn't change the mean. That eliminates (C) and (D).

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However, by adding a term at the middle of the set, it decreases the standard deviation, since the average difference from the mean is now a bit smaller. That eliminates (A).

The median is trickier. If none of the original 10 times were identical, the median must have been the average of 2 of those measurements. It's possible that in the original set of 10, the mean and the median were equal; for instance, that's the case if the numbers were consecutive. If they were equal, the median stays the same. If the mean and median were not equal, however, it's possible that the median does change. Choice (B) is correct.

43. C

Explanation: Call the number of visitors on the 2nd x . Then, the number of visitors on the 1st was $1.5x$. The number of visitors on the 3rd and 4th were each $\frac{3}{4}x$.

The average number of visitors per day, then, is:

$$\frac{1.5x + x + 0.75x + 0.75x}{4} = \frac{4x}{4} = x$$

The number of visitors on the 1st of the month was $1.5x$, so that is 1.5 times the average number of visitors, x . Choice (C) is correct.

44. C

Explanation: The average of the first 20 positive multiples of 5 will be equal to the median of those numbers, since a series of multiples of 5 are equally spaced. You can find the median by averaging the first and last terms in the set, which are 5 and 100. The median, then, is $\frac{5+100}{2} = \frac{105}{2} = 52.5$.

If $m = 52.5$, $\frac{m}{5} = \frac{52.5}{5} = \frac{105}{10} = 10.5$, choice (C).

45. B

Explanation: This overlapping sets question separates the 400 people in four groups: those who have a positive impression of A only, those who have a positive impression of B only, those who have a positive impression of both, and those who have a positive impression of neither. As a formula, those four groups sum to 400:

$$400 = A - \text{only} + B - \text{only} + \text{Both} + \text{Neither}$$

If we call the number of Both x , that means $2x$ had a positive impression of B only. Plugging in all the given values:

$$400 = 100 + 2x + x + 180$$

$$400 = 280 + 3x$$

$$3x = 120$$

$$x = 40$$

We're looking for the number of Both, which we called x , so we have our answer, choice (B).

46. C

Explanation: The total of 24,000 people is unnecessary. We can do the whole problem in terms of percents. If 88 percent own a car and 72 percent own both a car and a personal computer, that means the difference, 16 percent,

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own a car but not a personal computer. The probability of selecting someone from that 16 percent is 16 percent, but we need that in fractional form:

$$\frac{16}{100} = \frac{8}{50} = \frac{4}{25}, \text{ choice (C).}$$

47. A

Explanation: Write each side as 2 raised to a power:

$$((2^2)^{\frac{1}{3}})^n = 2^3$$

$$2^{\frac{2}{3}n} = 2^3$$

$$\frac{2}{3}n = 3$$

$$n = 3(\frac{3}{2}) = \frac{9}{2}, \text{ choice (A).}$$

48. D

Explanation: Any time a series of integers is equally spaced, be they consecutive evens, consecutive odds, or some other consecutive set, the mean is equal to the median, which is equal to the mean of the two endpoints. So, the mean of the evens from 100 to 200 is $\frac{100+200}{2} = 150$, and the mean of the odds from 75 to 125 is $\frac{75+125}{2} = 100$. 150 is 50 greater than 100, choice (D).

49. C

Explanation: Translate to algebra:

$$p = \frac{1}{2}(\frac{1}{2}q)$$

$$\frac{p}{100}q = 400$$

Substitute the first equation in for p in the second equation:

$$\frac{\frac{1}{4}q}{100}q = 400$$

$$\frac{1}{4}q^2 = 400(100)$$

Take the square root of both sides:

$$\frac{1}{2}q = 2(100)$$

$$q = 400, \text{ choice (C).}$$

50. C

Explanation: The first 8 positive evens are 2, 4, 6, 8, 10, 12, 14, 16. Look for ways to group the terms together to get products near a power of 10:

$$10 = 10^1$$

$$8(12) = 96 \approx 10^2$$

$$6(14) = 84 \approx 10^2$$

$$2(4)(16) = 128 \approx 10^2$$

We've approximately quite aggressively, but because we're rounding up in some cases and down in others, the differences largely cancel out. We've accounted for all 8 terms, so we can multiply those products together for our answer:

$$(10^1)(10^2)(10^2)(10^2) = 10^7, \text{ choice (C).}$$

51. D

Explanation: To maximize x , minimize y . Since both variables are positive integers, the smallest y could be is 1. Thus:

$$x^2 + y^2 = 100$$

6. EXPLANATIONS

$$x^2 + 1^2 = 100$$

$$x^2 = 99$$

Since 100 is 10^2 , 99 must be the square of a little less than 10 . The correct choice is (D).

52. E

Explanation: First, square both sides to get rid of the radicals:

$$(\sqrt{2-x})^2 = (\sqrt{2x-2})^2$$

$$2-x = 2x-2(2\sqrt{2x})+4$$

$$4\sqrt{2x} = 3x+2$$

Square both sides again to get rid of the remaining radical:

$$(4\sqrt{2x})^2 = (3x+2)^2$$

$$16(2x) = 9x^2 + 12x + 4$$

$$32x = 9x^2 + 12x + 4$$

$$20x - 4 = 9x^2$$

That's choice (E).

53. E

Explanation: Simplify both sides so that the base is the same:

$$(2^2)^{x+1} = (2^3)^{x-1}$$

$$2^{2x+2} = 2^{3x-3}$$

$$2x+2 = 3x-3$$

$$x = 5, \text{ choice (E).}$$

54. E

Explanation: To avoid trying all of the choices, think of cubes you are familiar. For instance, $3^3 = 27$, so $(-3)^3 = -27$. $4^3 = 64$, so $(-4)^3 = -64$. Since -43 is between those two endpoints, $\sqrt[3]{-43}$ must be between -3 and -4 , choice (E).

55. B

Explanation: Convert all the fractions so that they have a common denominator. Because the denominators are already written in terms of 2's and 5's, make the denominators equal to that of (E):

$$(A) \quad \frac{3 \times 2^2 \times 5}{2^4 5^3} = \frac{60}{2^4 5^3}$$

$$(B) \quad \frac{26 \times 2^2}{2^4 5^3} = \frac{104}{2^4 5^3}$$

$$(C) \quad \frac{9 \times 2 \times 5}{2^4 5^3} = \frac{90}{2^4 5^3}$$

$$(D) \quad \frac{49 \times 2}{2^4 5^3} = \frac{98}{2^4 5^3}$$

$$(E) \quad \frac{92}{2^4 5^3}$$

Now they are much easier to compare. (B) is the largest, so it's the correct answer.

56. A

Explanation: This looks daunting, but remember that the GMAT is testing a predictable range of concepts. This starts as the square of a binomial, so multiply it out:

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$$\begin{aligned}
 &(\sqrt{8 + \sqrt{63}} - \sqrt{8 - \sqrt{63}})^2 = \\
 &(\sqrt{8 + \sqrt{63}} - \sqrt{8 - \sqrt{63}})(\sqrt{8 + \sqrt{63}} - \sqrt{8 - \sqrt{63}}) = \\
 &8 + \sqrt{63} - 2(\sqrt{8 + \sqrt{63}})(\sqrt{8 - \sqrt{63}}) + 8 - \sqrt{63} = \\
 &16 - 2(\sqrt{(8 + \sqrt{63})(8 - \sqrt{63})}) = \\
 &\text{That second term is the difference of squares:} \\
 &16 - 2(\sqrt{64 - 63}) = \\
 &16 - 2(\sqrt{1}) = 16 - 2 = 14, \text{ choice (A).}
 \end{aligned}$$

57. A

Explanation: If $\frac{2}{3}C$ have at least two bedrooms, the number that have two bedrooms and two bathrooms, $\frac{1}{4}$ of those, is $\frac{1}{4}(\frac{2}{3}C) = \frac{1}{6}C$.

We're looking for the number of those $\frac{2}{3}C$ with two bedrooms that are not part of the $\frac{1}{6}C$ that also have two bedrooms, so we need to find the difference:
 $\frac{2}{3}C - \frac{1}{6}C = \frac{4}{6}C - \frac{1}{6}C = \frac{3}{6}C = \frac{1}{2}C = \frac{C}{2}$, choice (A).

58. C

Explanation: If $\frac{x}{y} = \frac{3}{5}$, then $\frac{y}{x} = \frac{5}{3}$. Putting those together:

$$\frac{x}{y} + \frac{y}{x} = \frac{3}{5} + \frac{5}{3} = \frac{9}{15} + \frac{25}{15} = \frac{34}{15}, \text{ choice (C).}$$

59. C

Explanation: If the average of x and y is 75, the sum of x and y is 150. Similarly, the sum of y and z is 180:

$$x + y = 150$$

$$y + z = 180$$

Since we're looking for the relationship between x and z , subtract the first equation from the second:

$$(y + z) - (x + y) = 180 - 150$$

$$z - x = 30, \text{ choice (C).}$$

60. B

Explanation: If the digits of A are x and y , we can say that $A = 10x + y$. (For instance, if A is 56, $x = 5$ and $y = 6$, so $56 = 10x + y$.)

If B has the same digits in reverse, $B = 10y + x$. The difference, then, is:

$$A - B$$

$$10x + y - (10y + x) = 9x - 9y = 9(x - y)$$

In other words, the difference will always be a multiple of 9. (B) is the only choice that is not a multiple of 9, so it's the correct answer.

61. D

Explanation: To find the units' digit, you don't need to calculate the actual result, just keep track of the units digits:

$(19)^2$ has the same units digit as 9^2 , which is 1.

$(23)^3$ has the same units digit as 3^3 , which is 7.

$(31)^4$ has the same units digit as 1^4 , which is 1.

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The units digit of the entire thing is the same as the units digit of $(1)(7)(1) = 7$, choice (D).

62. C

Explanation: If the ratio of flavoring to sugar is initially $2 : 10$ and is halved, the new ratio is $2 : 5$. If the ratio of sugar to water is initially $10 : 50$ and it is doubled, the new ratio is $20 : 50$, or $2 : 5$. We're given the amount of sugar and are looking for the amount of water. The relevant ratio is $2 : 5$, so we can set up an equation:

$$\begin{aligned}\frac{2}{5} &= \frac{4}{x} \\ 2x &= 20 \\ x &= 10, \text{ choice (C).}\end{aligned}$$

63. A

Explanation: It's easier to find what percentage each of the individual terms are of x rather than adding them together first.

$$\begin{aligned}\frac{x}{50} &= \frac{2x}{100} = \frac{2}{100}x, \text{ or } 2\% \text{ of } x. \\ \frac{x}{10} &= \frac{10x}{100} = \frac{10}{100}x, \text{ or } 10\% \text{ of } x. \\ \text{The sum of the two, then, is } 10\% + 2\% &= 12\% \text{ of } x, \text{ choice (A).}\end{aligned}$$

64. D

Explanation: Set up the average formula:

$$\begin{aligned}\frac{M+(2M-1)+(3M+5)+(5M-3)}{4} &= 25 \\ 11M + 1 &= 100 \\ 11M &= 99 \\ M &= 9, \text{ choice (D).}\end{aligned}$$

65. D

Explanation: 40 percent of the employees prefer Y, and 75 percent of employees will be moved there, so all 40 can be relocated to the city of their preference.

60 percent prefer X, but only 25 percent will be moved there, so only 25 percent will be relocated to their preference. That's a total of 65 percent of employees who will be relocated to the city of their preference.

There are 200 employees, so 65% of the number of employees is 130, choice (D).

66. B

Explanation: Work your way out from the innermost fraction:

$$\begin{aligned}1 + \frac{1}{2} &= \frac{2}{2} + \frac{1}{2} = \frac{3}{2} \\ \frac{2}{\frac{3}{2}} &= 2\left(\frac{2}{3}\right) = \frac{4}{3} \\ 3 + \frac{4}{3} &= \frac{9}{3} + \frac{4}{3} = \frac{13}{3} \\ \frac{4}{\frac{13}{3}} &= 4\left(\frac{3}{13}\right) = \frac{12}{13} \\ 5 + \frac{12}{13} &= \frac{65}{13} + \frac{12}{13} = \frac{77}{13}, \text{ choice (B).}\end{aligned}$$

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67. D

Explanation: To find the value of xy , you'll need to find out about both x and y . x is the product of 2 and s , while y is the product of b and t . Clearly there's more work to be done.

Look for variables that can be solved for. For instance, 10 is the product of r and 2, so $r = 5$. If $r = 5$, then 30 is the product of 5 and a , $a = 6$. If $a = 6$, then 18 is the product of t and 6, so $t = 3$.

Going back to $r = 5$, 20 is the product of 5 and b , so $b = 4$. That gives us all the information we need about y , because $y = bt = 4(3) = 12$.

To find x , we need the value of s . 4 is the product of b and s , and we know that $b = 4$, so $s = 1$. $x = 2s = 2(1) = 2$.

Finally, since $x = 2$ and $y = 12$, $xy = 24$, choice (D).

68. C

Explanation: The first step is to subtract the exponents from each other. Ignoring for a moment that they are an exponent:

$$\begin{aligned}(x - y)(x + y) - (x - 1)(x + 1) \\ x^2 - y^2 - (x^2 - 1) \\ -y^2 + 1\end{aligned}$$

We know that $y^2 = 2$, so $-y^2 + 1 = -2 + 1 = -1$.

Finally, if the exponent is -1, the answer is $2^{-1} = \frac{1}{2}$, choice (C).

69. B

Explanation: Since 9.9 appears in two of the choices, that's a good place to start. The cash prize could end up being 9.9 plus some number of zeroes if the two balls drawn were 99 and 100. Then, the product would be 9,900, and the cash prize would be 9,900 times \$1,000. To translate that to scientific notation:

$9.9 \times 10^3 \times 1 \times 10^3 = 9.9 \times 10^6$, choice (B). We're only looking for a possible answer, and since (B) is clearly possible, we're done.

70. B

Explanation: Ignore all the details of the types of cars—the key thing is that all of the mixes of cars involve some number of minivans. Write out an equation representing the number of minivans in each lot:

$$0.2m + 0.4n + 0.5p = 0.25(m + n + p)$$

In each term, the percent of minivans is multiplied by the total number of cars to give the number of minivans. The total number of minivans in each of the three dealerships is equal to 25% of the total number of cars in the three dealerships.

Solve for m :

$$0.2m + 0.4n + 0.5p = 0.25m + 0.25n + 0.25p$$

$$0.15n + 0.25p = 0.05m$$

$$15n + 25p = 5m$$

$$3n + 5p = m$$

Choice (B) is correct.

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71. E

Explanation: Statement (1) is insufficient: in both pairs of variables, they could be 4 and 2, respectively, 9 and 3, respectively, or even 1 and 1.

Statement (2) is insufficient: it gives no information about two of the four variables.

Taken together, we still don't have enough information. It means that a and d can't be 1 and 1, respectively, and that b and c can't be 9 and 3, respectively, but it leaves three sets of possible values for the four variables:

0.2114

0.9113

0.9423

Choice (E) is correct.

72. B

Explanation: Essentially, we're looking for the units digit of 4^{2a+1-b} . When 4 is raised to an integer power, the units digit is always either 4 (if the power is odd: 4, 64, etc.), or 6 (if the power is even: 16, 256, etc.). So what we really need to know is whether the power is even or odd.

Statement (1) is insufficient. $2a + 1 + b$ is always *even* + 1 + b regardless of the value of a , since that value is multiplied by 2.

Statement (2) is sufficient: $2a + 1 + b = \text{even} + 1 + 2 = \text{even} + 3 = \text{odd}$, so no matter what the value of a , the power is odd, the the remainder is 4. Choice (B) is correct.

73. C

Explanation: The question gives us several pieces of information:

$$0.35b = n$$

$$0.35b = p$$

$$0.2p = \text{novelsBefore1940}$$

All of these are in terms of percents, so if we want a number, we need a number.

Statement (1) doesn't give us another number: it's another ratio, so we can't find an actual amount.

Statement (2) gives us a number, but it doesn't relate to any of the percents. We don't know anything about the size of the collection on the basis of this information.

Combining the two statements, we have enough information. If 100 non-fiction books constitute half of the collection, the total number of books is 200. With that, we can find the number of paperbacks, and from there, the number of paperbacks that are novels published before 1940. Choice (C) is correct.

74. C

Explanation: Statement (1) is insufficient. If a number is divisible by 9, the digits must sum to 9. $2 + 3 + 4 = 9$, so $2 + 3 + H + 4$ will sum to a multiple of 9 if $H = 0$ or if $H = 9$.

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Statement (2) is also insufficient. If a number is divisible by 4, the number formed by the last two digits must be a multiple of 4. There are many possibilities for H here: it could be 0, 2, 4, 6, or 8.

Taken together, the statements are sufficient. (1) gives only two possibilities for H , and (2) only allows for one of them. $H = 0$, so choice (C) is correct.

75. B

Explanation: The question gives us an inequality:

$$x < 0.75y$$

And the question:

$$x < 75 ?$$

Statement (1) is insufficient. If $y > 20$, $0.75y > 15$, so the question is: "is something less than something greater than 15 less than 75?" Without knowing more about the range of y , we can't answer the question.

Statement (2) is sufficient. We can substitute the equation into the equation given in the question:

$$x < 0.75y$$

$$x < 0.75(x + 25)$$

$$x < 0.75x + \frac{3}{4}(25)$$

$$0.25x < \frac{3}{4}(25)$$

$$x < 3(25)$$

$$x < 75$$

Combining our pieces of given information directly answers the question.

76. C

Explanation: Statement (1) is insufficient. It gives us the relationship between the number of women under 60 to those at least 60. By extension, it gives us the relationships between those subgroups and the total number of women, but since we don't have numbers or percents for any of those three, it's not good enough.

Statement (2) is also insufficient. Since we know 25 percent of total residents are 60 or older, 75 percent are under 60. If 37 percent of the total are males under 60, that leaves 38 percent who are females under 60. Still, we don't know how many females are 60 or older.

Taken together, the statements are sufficient. (2) tells us what percent of the total are females under 60, and (1) gives us the relationship between that number and the total number of female residents, which is what we're looking for. (C) is correct.

77. A

Explanation: The mean and median of a set will always be equal if the set consists of consecutive (equally-spaced) numbers. There are other times when the mean and median are equal, but the GMAT likes to test the first concept.

Statement (1) is sufficient: if the terms are consecutive evens, they are equally spaced, so the mean and the median are the same.

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Statement (2) is insufficient. That the mean of the set is equal to the mean of the largest and smallest numbers doesn't tell us anything about how the inner numbers are arranged; there are far too many variables concerning how the numbers are spaced to know how the median relates to the mean. Choice (A) is correct.

78. C

Explanation: Statement (1) is insufficient, but it does narrow down your options. There are only five possible remainders when a number is divided by 5: the integers between 0 and 4, inclusive. So the remainder must be no greater than 4.

Statement (2) is also insufficient: the possible remainders when a number is divided by 10 are the integers from 0 to 9, inclusive, and if the remainder is greater than 3, that leaves all the integers from 4 to 9, inclusive.

Taken together, the statements are sufficient. (2) limits our options to the integers from 4 to 9, and (1) limits our options to those from 0 to 4. The only possibility that satisfies both statements is a remainder of 4. Choice (C) is correct.

79. E

Explanation: Statement (1) is insufficient. The least common denominator of the two fractions would be 20 if $s = 20$, $s = 10$, or $s = 5$.

Statement (2) is also insufficient: it doesn't tell us anything about s at all.

Taken together, the statements are still insufficient. $\frac{r}{s}$ could have any of the values of s outlined in (1) as its denominator: $\frac{1}{20}$ or $\frac{1}{5}$, for example, would result in a least common denominator with $\frac{1}{4}$ of 20. Choice (E) is correct.

80. D

Explanation: Statement (1) is sufficient: the only one of the four operators that combines 2 and 5 to return 10 is multiplication. Thus, $5 \nabla 2 = 5 \times 2 = 10$.

Statement (2) is also sufficient: again, only multiplication causes 5 and 5 to combine and return 25. That gives us only one possible result for $5 \nabla 2$. Choice (D) is correct.

81. A

Explanation: The number who do not participate in debate is the number who only participate in student government, since we're given the total number of those who participate in one or the other, or both.

Statement (1) is sufficient. 250 is the sum of those who participate in government only, debate only, and both. We're given both, and (1) gives us debate only (those who don't do government), so we can solve for those who do government only.

Statement (2) is not sufficient: it doesn't relate to our 250 students at all: it tells us that there are 150 other students at the school who are not included in the sample we're working with. Choice (A) is correct.

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82. E

Explanation: Statement (1) rules out 5 and 6, which have the same units digits when squared. That leaves several possible values, though.

Statement (2) limits our options to 4, 5, 6, and 9, all of which have the same units digits when cubed.

Taken together, the statements are still insufficient. (1) eliminates 5 and 6, but (2) leaves us with 4 and 9, so choice (E) is correct.

83. A

Explanation: Statement (1) is sufficient. Between the question and (1), we know the total percent of students who have birthdays on an even-numbered day: 55 percent. That leaves 45 percent on odd-numbered days.

Statement (2) is not sufficient. Knowing what percent of odd-numbered birthdays are in the first three months of the year doesn't help us find the total percent of odd-numbered birthdays. Choice (A) is correct.

84. C

Explanation: The important value to know in determining whether a number converts to a terminating decimal is the denominator. Any fraction with a denominator of 3 will not terminate, but any fraction with a denominator of 4 will terminate (for example).

Statement (1) is insufficient: we know that the denominator is 2, 3, 5, or 7. If the denominator is 2 or 5, the decimal terminates, as the decimal part will always be 0 or 0.5 (in the case of 2), or one of 0, 0.2, 0.4, 0.6, and 0.8, in the case of 5. However, if the denominator is 3 or 7, the decimal will not terminate unless $\frac{p}{q}$ is an integer.

Statement (2) is also insufficient. It gives us an infinite range of possible denominators, including 2 (which always terminates) and 9 (which never does, unless the fraction converts to an integer).

Taken together, the statements are sufficient. (2) limits the options of (1) down to 2 and 5, which, as we've seen, always terminate. Choice (C) is correct.

85. B

Explanation: Statement (1) is insufficient. Just working from the terms given, if $p = 3$, it looks like all the terms of divisible by p . But if $p = 11$, it's true that one term is divisible by p , but not all the terms are divisible by p .

Statement (2) is sufficient. If you figure out a few more successive terms, it becomes apparent that all the terms in the sequence are divisible by 3. For instance:

$$Z_4 = 2^{2(4)-1} + 1 = 2^7 + 1 = 129$$

$$Z_5 = 2^{2(5)-1} + 1 = 2^9 + 1 = 513$$

You could spend all day trying to prove it, but on the GMAT, better to trust that the pattern is as it appears. The GMAT will rarely include a sequence like this that has a "surprise" in the 9th or 10th term. Choice (B) is correct.

86. E

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Explanation: Statement (1) is insufficient. It's possible that one of the two variables is equal to 56, but we don't know whether that's the case, and we don't know how many of the other four variables are, either.

Statement (2) is also insufficient. Again, it's possible that one or two of the variables are equal to 56, but we don't know how many, or if any are at all. And again, we don't know anything about three of the variables.

Taken together, we still don't have enough information. We can find the value of the sixth variable, k , but we still don't know much about the five that are included in (1) and (2). Choice (E) is correct.

87. D

Explanation: We have the relationship between the before and after revenues for A and the before and after revenues for B, but nothing to link A and B.

Statement (1) is sufficient: the original revenues for A and B were the same. If we call both of those x , we can express the reduced monthly revenue of B in terms of x , and find the relationship the question asks for.

Statement (2) is also sufficient. We now have a series of ratios. We can express the increased revenue of A and the reduced revenue of B in terms of the same variable, which means we can also express the original revenue of A in terms of that variable, which allows us to link the reduced revenue of B and the original revenue of A. Choice (D) is correct.

88. A

Explanation: If you listed all the powers of 7, you'd see a pattern in the units digits:

1
7
49
343
2401

It's a four-term sequence. The 1st, 5th, 9th, etc. terms are the same, and the 4th, 8th, 12th, etc. terms are the same, as long as all we care about is the units digit.

What that means here is that the $4n$ term doesn't matter: we know that it will result in a multiple of 4. What matters isn't how large the exponent is, it's the remainder when the exponent is divided by 4. That depends entirely on m , and not at all on n .

Statement (1) is sufficient: since we have the value of m , we know that the exponent is a multiple of 4 plus 10, which is the same as a multiple of 4 plus 2. That means we're looking at the series of powers of 7 including the 2nd, 6th, 10th, etc.

Statement (2) is insufficient: it doesn't tell us anything about the exponent's remainder when divided by 4, only how big it is. Choice (A) is correct.

89. E

6. EXPLANATIONS

Explanation: Statement (1) is insufficient. The average of the first ten positive multiples of 5 is equal to the median, which is equal to the mean of the endpoints, all because the series is equally spaced. Thus, the number in question is $\frac{5+50}{2} = 27.5$. If x is less than 27.5, we don't know whether it's bigger than 25.

Statement (2) is also insufficient. Using the same reasoning, we can determine that x is greater than $\frac{5+40}{2} = 22.5$. Again, that doesn't tell us whether it's bigger than 25.

Taken together, the statements are still insufficient. If x is between 22.5 and 27.5, we don't know whether it's larger than 25. Choice (E) is correct.

90. C

Explanation: We need to know the total number who have a doctorate, which would give us the number who have a doctorate and are under 50, since we already know how many have a doctorate and are over 50.

Statement (1) is insufficient: if 15% are under 50 and do not have a doctorate, we can determine the corresponding number, but it doesn't help us with the number of under-50s who do have a doctorate.

Statement (2) is insufficient as well: if 70% are over 50, we can find the corresponding number, and also the number who are over 50 and do not have a doctorate, since we know the number of those over 50 who do have a doctorate.

Taken together, the statements are sufficient. (1) gives us the number who are under 50 and do not have a doctorate, and (2) allows us to find the number who are over 50 and do not have a doctorate. Combined, that gives us the number who do not have a doctorate, which is sufficient to find the total number who do have a doctorate. As we established at the outset, that's enough information to find the number who are 50 years old or less and have a doctorate. Choice (C) is correct.

91. A

Explanation: Statement (1) is sufficient. If we know the remainder when a number is divided by 12, we know the remainder when it is divided by a factor of 12 (such as 3). In this case, since p is 7 greater than a multiple of 12, it is 7 greater than a multiple of 3, which means it is 4 greater than the next multiple of 3, and 1 greater than the next multiple of 3. The remainder, then, is 1.

Statement (2) is insufficient. $n(n+1)$ is the product of two consecutive integers. If one of those two integers is a multiple of 3—for instance, if $n = 3$ —then the product is a multiple of 3, and $n(n+1) + 1$ has a remainder of 1 when divided by 3. However, if neither of the integers are a multiple of 3—for instance, if $n = 1$ —then the product is not a multiple of 3. If $n = 1$, $n(n+1) + 1 = 3$, which has no remainder when divided by 3. Choice (A) is correct.

92. B

Explanation: Statement (1) is insufficient. If the tenths digit of $100m$ is 5, the hundredths digit of $10m$ is 5, and the thousandths digit of m is 5. That doesn't tell us the hundredths digit.

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Statement (2) is sufficient. If the tens digit of $1,000m$ is 5, the units digit of $100m$ is 5, the tenths digit of $10m$ is 5, and the hundredths digit of m is 5. That's what we're looking for, so (B) is the correct choice.

93. A

Explanation: Statement (1) is sufficient. The median of three integers is always one of the integers. If two of the integers are equal, the median is one of those integers, and equal to both of them. The three integers line up in one of two ways: a, c, b , or b, a, c . Either way, c is equal to the median.

Statement (2) is insufficient. It's possible that c is the median, if $a = 3$, $b = 7$, and $c = 5$, larger than the difference of 4. However, c doesn't have to be the median: if $a = 3$ and $b = 7$ again, $c = 10$ is also larger than the difference of 4. Choice (A) is correct.

94. A

Explanation: Call the number who study Spanish s , the number who study Mandarin m , and the number who study both b . The question tells us that $0.1s = b$.

Statement (1) tells us that $0.06m = b$. That means we can solve for each of m and s in terms of b :

$$0.1s = b$$

$$s = 10b$$

$$0.06m = b$$

$$m = \frac{100b}{6} = \frac{50b}{3} = 16\frac{2}{3}(b)$$

In terms of b , there are more students studying Mandarin.

Statement (2) is insufficient, not to mention irrelevant. We're working only with percents, and with those students who study one of the two languages. Knowing how many students study neither doesn't help in this example. Choice (A) is correct.

95. A

Explanation: The question tells us that $r = m - 1$, and we're looking for m , the number of members in each row.

Statement (1) is sufficient. It says that $rm = 90$, and with two equations involving the two variables, we can solve for the value of m .

Statement (2) is insufficient. We don't know by what method the members of the last row are assigned to different rows; if we knew that one was assigned to each of the remaining rows, we might be able to solve, but for all we know, all the members of the last row were assigned to the first two rows, or any number of other possible permutations. Choice (A) is correct.

96. E

Explanation: Statements (1) and (2) are both insufficient on their own: neither gives information about all six bodies of water. To solve for standard deviation, at the very least, you need to have all the relevant information about all the terms.

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Taken together, the statements are still insufficient. We don't know whether the bodies increased or decreased relative to the mean, which determines the standard deviation. If the two bodies of water that decreased the most, for instance, were already below the mean, the standard deviation increases. But if they were above the mean and decreased, it's possible that the standard deviation decreased as those terms got closer to the mean. Choice (E) is correct.

97. A

Explanation: Statement (1) is sufficient. The only one of the operations that combines 1 and 2 to result in a negative number is subtraction: $1 - 2 = -1$. Thus, the answer to the question is $2 - 3 = -1$.

Statement (2) is insufficient. -2 and -1 result in a negative number if you add or subtract them. Those two operations give different results for 2 and 3, so choice (A) is correct.

98. C

Explanation: Statement (1) is insufficient: it tells us a portion of the number of countries in which the unemployment rate didn't drop, which isn't enough to find in how many it did drop.

Statement (2) is also insufficient: again, we know some of the countries in which the unemployment rate didn't drop, but not the total number.

Taken together, the statements are sufficient. (1) and (2) combined give us the total number of countries in which the unemployment rate did not drop, 22. If there are 28 total countries, there are 6 in which the unemployment rate did drop, which is what we're looking for. (C) is correct.

99. B

Explanation: Statement (1) is insufficient: if the units digit of n^2 is 9, n could have a units digit of 3 ($3^2 = 9$) or 7 ($7^2 = 49$).

Statement (2) is sufficient: the only units digit of n that results in a units digit of 7 for n^3 is 3: $3^3 = 27$. Choice (B) is correct.

100. D

Explanation: Statement (1) is sufficient. Call the middle number x , and the difference between it and the smallest number y . Thus, the smallest number is $x - y$. If the range is double that difference, it's $2y$, which means the largest number is $(x - y) + 2y = x + y$. The median of the three terms $x - y$, x , $x + y$ is x , and the average is:

$$\frac{(x-y)+x+(x+y)}{3} = \frac{3x}{3} = x$$

The mean and median are the same.

Statement (2) is sufficient, and more straightforward. The median is 16, and the mean is $\frac{10+16+22}{3} = \frac{48}{3} = 16$. Choice (D) is correct.